ENVIRONMENTAL TECHNOLOGY VERIFICATION REPORT FOR INSTALLATION OF SILT FENCE USING THE TOMMY® STATIC SLICING METHOD

Prepared by the Environmental Technology Evaluation Center (EvTEC), a CERF Innovation Center

CERF Report: #40565
March 2001

Cover photos
Left and Center: Existing layout of site #1.
Right: Installation of silt fence using Tommy machine in densely vegetated area.

Abstract

This verification report describes a field evaluation of the installation of a silt fence using the Tommy® Silt Fence Static Slicing Method and compares this method to traditional trenching methods. The slicing method has been used extensively over the past few years but has not undergone a true field application test by a third party. State Departments of Transportation and federal, state, and local environmental regulatory agencies have expressed a desire and, in some cases a need, for baseline environmental data providing a general picture of performance and feasibility of the Tommy Slicing Method for silt fence installation and erosion control.

Library of Congress Cataloguing-in-Publication Data

Environmental technology verification report for installation of silt fence using the Tommy static slicing method/by TRI/Environmental, Inc. under contract to the Environmental Technology Evaluation Center (EvTEC).

p. cm.
Includes bibliographical references and index.
ISBN 0-7844-0565-4
1. Soil stabilization. 2. Sediment control. 3. Soil erosion. I. Title: Installation of silt fence using the Tommy static slicing method. II. TRI/Environmnetal, Inc. III. Environmental Technology Evaluation Center (U.S.)

TA749.E58 2001
624.1'51363--dc21

2001022754

Library of Congress Catalog Card No: 0-7844-0565-4
ISBN 0-7844-0565-4
Manufactured in the United States of America.

Disclaimer

The information in this document has been funded in part by the U.S. Environmental Protection Agency (EPA) under a Cooperative Agreement (#82488-4-01-0) with the Civil Engineering Research Foundation's (CERF) Environmental Technology Evaluation Center (EvTEC). This verification effort was supported under the EPA's Environmental Technology Verification Program. This verification effort has been subjected to EPA's and CERF's peer and administrative review. The Tommy® Static Slicing Method was verified by EvTEC under the CERF Innovation Center Program as a method of installation of silt fence in January 2001. EPA and EvTEC make no expressed or implied warranties as to the performance of the method. Mention of corporation names, trade names, or commercial products does not constitute endorsement or recommendation for use of specific products.

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Abbreviations and Acronyms

ASCE	American Society of Civil Engineers
BMP	best management practice
CERF	Civil Engineering Research Foundation
CFR	Code of Federal Regulations
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
ETV	Environmental Technology Verification
EvTEC	Environmental Technology Evaluation Center
ft	foot
gals	gallons
lbs	pounds
mins	minutes
NPDES	National Pollutant Discharge Elimination System
pcf	pounds per cubic foot
psi	pounds per square inch
QA	Quality Assurance

Preface

As is the case with many environmental studies and pilot testing projects, this evaluation had its share of overseeing/participating parties who have contributed to plan formulation and evaluation observation and documentation. The principal parties involved with this project were:

- Carpenter Erosion Control;
- U.S. Environmental Protection Agency (EPA);
- The Environmental Technology Evaluation Center (EvTEC);
- TRI/Environmental, Inc., a third-party, contracted, independent testing organization; and
- The Technology Evaluation Panel (see p. xi for a listing).

EvTEC operates as an independent entity of the Civil Engineering Research Foundation, the research and technology transfer arm of the American Society of Civil Engineers. EvTEC is under contract to Carpenter Erosion Control to perform a technology verification of the Tommy® Silt Fence Slicing technology. Part of this evaluation process involved assembling a Technology Evaluation Panel of experts and users who are knowledgeable in erosion control principles and practices. EvTEC developed the Evaluation Plan through contact and consensus building within the Technology Evaluation Panel.

The mission of EvTEC is twofold. The first is to verify the performance of new, commercially-ready environmental technologies and products that have the potential to serve public and private needs. The second is to transfer this information to those who recommend, specify, approve, or purchase these technologies. EvTEC is a key component of the EPA Environmental Technology Verification program designed to advance innovative environmental technologies. EvTEC is unique as compared to other verification programs because it is a market-based, private-sector effort rather than a government program. The program is flexible enough to include technologies across the spectrum of pollution prevention, pollution control, environmental remediation/restoration, and monitoring.

TRI/Environmental, Inc., an independent, third-party laboratory under contract to EvTEC, supervised all verification testing undertaken for this project.

Acknowledgments

The Environmental Technology Evaluation Center (EvTEC) acknowledges the support of all those who helped plan and conduct the verification activities. In particular, we would like to thank Norma Lewis, U.S. Environmental Protection Agency (EPA) Environmental Technology Verification (ETV) Project Manager, and Lauren Drees, EPA ETV Project Quality Assurance/Quality Control Manager, both of EPA's National Risk Management Research Laboratory in Cincinnati, Ohio.

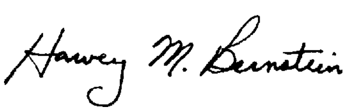
We would also like to thank the Tommy Static Slicing Silt Fence Machine Evaluation Panel: James Barrett, Virginia Department of Transportation; Patricia Cazenas, P.E., L.S., Federal Highway Administration; Robert R. Connelly, II, C.P.E.S.C., Virginia Department of Conservation and Recreation; Rod Frederick, P.E., EPA; Carol Forrest, P.E., URS Greiner Woodward Clyde; John C. Hayes, Ph.D, Clemson University; Flint Holbrook, Ph.D., P.E., Woolpert Consultants; James Magnus, Georgia Department of Transportation; Jay Michels, Minnesota Pollution Control Agency; Francis M. Nevils, P.E., North Carolina Department of Environment and Natural Resources; Paul Northcutt, Texas Department of Transportation; Edward G. Stein, Jr., ACF Environmental (International Association of Erosion Control); and Ruth Hathaway, Hathaway Consulting, LLC (EvTEC's Quality Assurance Manager).

In addition, we would like to thank Joel Sprague, P.E., TRI/Environmental, Inc., for his assistance as the lead consultant during this product evaluation and for his efforts preparing this report. We would also like to acknowledge the assistance and participation of Tom Carpenter of Carpenter Erosion Control.

Among the staff who worked on this project, I wish to acknowledge the efforts of EvTEC's Director William E. Kirksey, P.E.; EvTEC Senior Program Manager, Brian Rustia, P.E.; and CERF Communications Specialist, Aimée Stoffel.

Publication of this report is made possible in part through the contributions by members of CERF's New Century Partnership:

- Black & Veatch
- CH2M Hill Ltd.
- Charles Pankow Builders
- Charles J. Pankow Matching Grant
- Kenneth A. Roe Memorial Program
- Lester B. Knight & Associates
- Parsons Brinckerhoff, Inc.
- The Turner Corporation



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Verification Statement

Environmental Technology Evaluation Center's Verification Statement for the Carpenter Erosion Control Tommy Silt Fence Slicing Method

Technology Type:	Erosion and Sediment Control Technology
Application:	Best Management Practice for Stormwater Management Related to Construction Activities
Technology Name:	Static Slicing Silt Fence Installation
Company:	Carpenter Erosion Control
Address:	3718 South West Court Ankeny, Iowa 50021
Phone:	800.965.1267
Fax:	515.964.0151
URL:	www.tommy-sfm.com

The performance verification activities described in this document were funded in part by Carpenter Erosion Control and the U.S. Environmental Protection Agency (EPA). The Civil Engineering Research Foundation's (CERF) Environmental Technology Evaluation Center (EvTEC) has a Cooperative Agreement (# 824884-01-0) with the EPA. The Independent Pilot Project under the EPA Environmental Technology Verification (ETV) Program supported this verification effort. This Verification Statement provides a summary of the performance results for the Carpenter Erosion Control Tommy® Silt Fence Static Slicing Machine.

Program Operation

The CERF EvTEC program, in partnership with a panel of experts, i.e., a unique EvTEC Technical Evaluation Panel and recognized testing organizations, objectively and systematically documents the performance of commercial-ready technologies. Together with the full participation of the technology developer, they develop plans, conduct tests, collect and analyze data, and report findings. Verifications are conducted according to a rigorous work plan and established protocols for quality assurance. CERF's EvTEC program acts as an objective third-party evaluation service. Where existing data are used, the data must have been collected by independent sources using similar quality assurance protocols.

The EPA's ETV program, through the National Risk Management Research Laboratory, has partnered with CERF, under an ETV Independent Pilot Project, to verify the performance of environmental technologies. The EPA created the ETV program to facilitate the deployment of innovative environmental technologies through performance verification and information dissemination. The goal of the EvTEC and ETV programs is to enhance environmental protection by substantially accelerating the acceptance and use of innovative, improved, and cost-effective technologies. The primary mission of the EvTEC and ETV programs is to assist and inform individuals and organizations requiring credible data concerning the design, distribution, permitting, and purchase of environmental technologies with balanced, third-party analyses of the performance of individual systems and technologies.

Technology Description

The Tommy Silt Fence Static Slicing Machine was developed in 1996. Static slicing is defined as the insertion of a narrow custom-shaped blade at least 10 inches into the ground and simultaneously pulling silt fence fabric into the opening created as the blade is pulled through the ground. The blade imparts no vibration or oscillatory motion. The tip of the blade is designed to slightly disrupt soil upward, preventing horizontal compaction of the soil and simultaneously creating an optimum soil condition for future mechanical compaction. Compaction follows (typically two passes on each side of the fabric) using a tire on the tractor used to pull the slicing machine. Post setting and driving, followed with attaching the fabric to the post, finalizes the installation.

Evaluation Description

The primary objective of the evaluation was to perform well-defined field tests to provide data on a standard trench silt fence installation and the Carpenter Erosion Control Tommy Silt Fence Static Slicing Machine's performance. The data, as summarized within this Verification Report, are being made available for distribution to federal, state, and local environmental regulators and to the erosion and sediment control community. The goal of this report is to provide potential users and purchasers of the Tommy Silt Fence Machine, "the Tommy," with performance information so that they can make informed decisions about selecting the Tommy for the installation of silt fence at their local construction sites.

At the outset of the project, the Technical Evaluation Panel members developed a list of questions regarding both the trench silt fence installation and the Tommy. From this list, several objectives were established to test the technology. Accordingly, the trench installation and the Tommy were evaluated by EvTEC using the technology evaluation process developed by the Technical Evaluation Panel to:

- Determine if the slicing method of silt fence installation (using the Tommy Silt Fence Static Slicing Machine) is superior to the trenching method;
- Determine if the slicing method is more cost-effective to install than the trenching method; and,
- Detail the implementability, including ease of operation and installation, of each method.

Details of the evaluation, including data summaries and discussion of results, may be found in this Verification Report. Productivity data, performance data, and density data from the field activities are available upon request from EvTEC.

Verification of Performance

In early August 2000, EvTEC performed an evaluation of silt fence installation methods at a test site outside of Des Moines, Iowa. Representatives of TRI/Environmental, Inc., oversaw the field operations and acted as EvTEC's independent oversight for the project. The field evaluation included 51 test segments reflecting different soil types, different installation methods, and different hydraulic conditions. The field testing lasted approximately one week, and the resulting data have been compiled into this Verification Report.

One site with a soil type predominately made up of silty clay was the primary test site. More tests were performed than originally outlined in the Evaluation Plan, allowing alternative schemes to be evaluated in order to further define the benefits of each installation type (slicing versus trenching) under a variety of conditions. The amounts of backfill, degrees of compaction, spacing of posts, volumes of runoff, and soil types were the evaluation variables. Additionally, installation sequence, such as installing posts before versus after compaction, was evaluated. Performance (water retention) and efficiency (installation time) were evaluated. Modifications to the initial Evaluation Plan are noted in this Verification Report.

The static slicing method provided storm water retention as good as or better than the "best" trenched installation (trenching installation definitions may be found in Section 2.2), and far superior to common installations. The "best" trenched installation typically required nearly triple the time and effort to achieve this comparable result. Trenching techniques meeting only minimum or marginally enhanced specification requirements fared quite poorly. The conclusion was clear that when the enhancements of the "best" trenched installations were not performed, the trenched installation performed poorly.

The static slicing method provided much quicker installations than any trench method installation attempted. The static slicing method was found to be much more efficient, and therefore cost-effective (i.e., man-hour savings) technique for silt fence installation when compared to a range of traditional trench-based procedures. Static slicing ranged from 1.75 to 4 times faster than all trench-based installation techniques.

Runoff retention tests measured the ability of an arc segment of installed silt fence to retain runoff. Poorly performing test segments generally experienced excessive seepage and, in the worst case, subsequent blowout of soil in the trench. No blowouts were experienced by segments installed using slicing or the “best” trenching techniques. Segments installed using the minimum specification requirements generally experienced both excessive seepage and blowout, even though the high clay content of soils made them significantly resistant to piping.

The static slicing method offers practical advantages over traditional trenching-based methods, such as maneuverability, minimal soil-handling and hand labor, consistent depth and compaction, and ease of installation in windy conditions, on steep side slopes, through rocky soils, and in saturated soils.

Mechanical installation by static slicing minimizes the hand labor requirements, as well as the potential backfill and compaction problems, associated with trenching. As a result, static slicing can be expected to provide uniform, dependable installations.

Compaction Benefits

Performance trends provide a clear indication that a greater level of compaction, i.e., higher density obtained, corresponds to better performance (greater water retention). System comparisons showed that slicing resulted in installations that had both higher densities and greater water retention than all trenching-based installations.

Trenching-based installations were affected by the inability to compact effectively when posts were installed first, when insufficient backfill material was placed in the trench, or when inadequate compaction effort was provided. It should be noted that the installations using static slicing also required reasonable compaction efforts to perform properly.

During the field testing, compaction densities were measured with a nuclear density gauge and a handheld cone penetrometer. There was a significant correlation between the cone penetrometer readings and the nuclear density measurements. This may indicate the hand penetrometer, a tool that is much easier and less expensive to operate than the nuclear density gauge, can be an effective field quality assurance tool.

From the field testing performed for this evaluation, there appear to be two possible ways to achieve maximum silt fence performance – static slicing or the “best” trenching-based installations. There is no clear, generally-accepted specification to obtain this “best” trench-based installation.

In all cases, static slicing produced silt fence installations as good as or better than the very best trench-based installations. This finding provides an important argument for toughening trench-based specifications with more specific requirements for backfilling and mechanically compacting the soil.

The combination of maximum performance and maximum productivity was achieved by static slicing in the EvTEC testing. The static slicing method is included in American Society for Testing and Materials (ASTM) D 6462 and should be strongly considered for incorporation into future project specifications where the existing trench specification is vague or loosely defined.

Original Signed By

3/21/01

William Kirksey Date
Director, EvTEC Program